Confirmatory Survey
Building 4064 Site
Santa Susana Field Laboratory
Boeing - Rocketdyne
Ventura County, California

Prepared By
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Radiation Assessment Unit
Radiologic Health Branch

Introduction and Site History:

The Building T064 Side Yard was occasionally used for storage of recoverable uranium scrap, irradiated fuel elements, and miscellaneous radioactive wastes. In the early 1960's the drain plug of a lead-pig cask containing irradiated "Seawolf" fuel and contaminated water failed and allowed the contaminated water to lead into the side yard. A 65 square meter area was excavated immediately following the incident. However, a 1988 comprehensive radiological survey of the area around building T064 identified elevated soil concentrations of Cs-137 (and an assumed equivalent amount of Sr-90). Further investigations determined that a 47 square meter area of contamination was located within the northeast fence line and extended in the northeast direction past the fence line over and additional area of 370 square meter. A Cs-137 guideline was developed and the top 41 cm of soil was, subsequently, excavated from the area and a post-remedial action survey performed and documented.

Reference Document(s):

1. Boeing Letter (99RC-2121) from Phil Rutherford to Stephen Hsu (RHB), "Release of Area 4064 at the Santa Susana Field Laboratory", April 14, 1999.
2. Boeing Letter (99RC-2003) from Majelle Lee to Michael Lopez (DOE), "Final Status Survey Report of Area 4064 at the Santa Susana Field Laboratory", April 14, 1999.
3. Rocketdyne Report RS-00003, P. Liddy, "Area 4064, Final Status Survey Report", April 13, 1999.
4. ORISE Letter from T.J. Vitkus to A. Gupta (DOE), "Second Addendum to the Verification Survey of the Building T064 Side Yard, Santa Susana Field Laboratory, Ventura County, California (ORISE 1993 and 1995)", January 25, 1999.
5. ORISE Report, T.J. Vitkus, "Verification Survey of Buildings 005, 023, and 064 Santa Susana Field Laboratory Rockwell International Ventura County, California", October 25, 1994.

Survey Personnel:

Roger Lupo, Lisa Brown and Xaiosong Yin

Survey Instruments:

Manufacture & Model	S/N	Probe/detector	S/N	Calibration date
Ludlum model 19	109936	internal 1x1 NaI	n/a	5/99
Ludlum model 2221	126531	Ludlum 44-10 2x2 NaI	Pr038043	11/98
Ludlum model 3	134076	Ludlum 44-2 1x1 NaI	Pr137133	11/98
Ludlum model 3	134215	Ludlum 44-2 1x1 NaI	Pr137117	11/98
Eberline ESP-2	0406	Ludlum 44-9 G-M pancake	Pr043314	11/98
Reuter-Stokes RSS112	J-165	Pressured Ion Chamber	H-3594	6/16/99

Survey of Building 4064 Site:

On October 7, 1998 staff from the Radiologic Health Branch, Radiological Assessment Unit surveyed the former site of Building 4064 (previously named T064). The site was surveyed with gamma detection (NaI) instruments and with exposure rate instruments (Reuter-Stokes Pressured Ion chamber). The range of gamma radiation detected by the 1x1 NaI was 3200- to 4000-cpm as compared to a background range of 3200- to 3900-cpm. The exposure rate as measured by the Pressurized Ion Chamber averaged 13.6 μR/hr at one meter above the ground and 14.4 μR/hr at the surface. Both exposure rate measurements are close to background levels. Two soil samples were collected from the runoff area along the side of the driveway to Building 4064 as this location had previously been identified as having Cs-137 contamination prior to remediation. Figure 1 shows the location of the exposure rate measurements and the soil sample locations.

Figure 1: Sampling Locations.

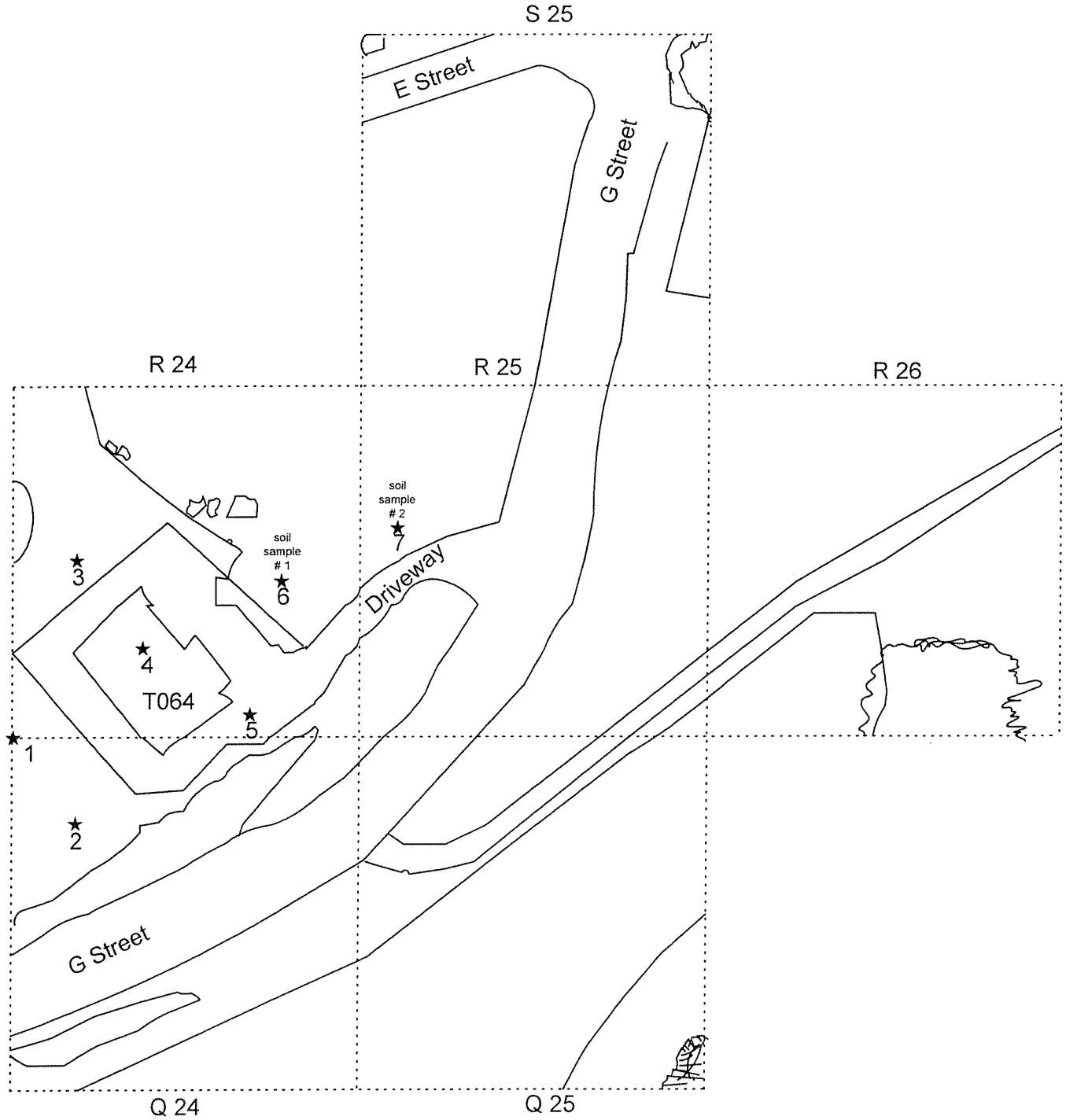

Figure 1
Building 4064 Site
★ PIC measurement Location

Table 1: Background Measurements: Collected from dirt area at driveway and concrete pad off of 10th street.

Meter	Reading
Ludlum M-19 Rate meter (μR/hr)	15 μR/hr
Eberline ESP – 2 survey meter w/ Ludlum 44-9 G-M pancake probe	82 cpm
Reuter-Stokes Pressurized Ion Chamber RSS112	14.0 μR/hr @ surface 13.5 μR/hr @ one meter
Ludlum model 2221 Scaler/Ratemeter w/ Ludlum 44-10 (2x2 NaI)	3500 cpm – 4300 cpm
Ludlum model 3 survey meter w/ Ludlum 44-2 (1x1 NaI)	3200 cpm – 3900 cpm

Table 1: General survey measurements with the Reuter-Stokes Pressurized Ion Chamber (PIC)
Measurements in μR/hr.

Location	PIC @ one meter	PIC @ surface	M-19 @ one meter	M-19 @ surface
1	13.4	14.2	14.0	15.5
2	13.5	14.6	13.5	15.0
3	13.2	13.9	13.0	14.5
4	13.3	14.4	13.0	15.0
5	13.0	13.6	13.0	14.5
6	13.8	14.8	14.0	14.5
7	14.7	15.2	15.0	15.5

Table 2: Soil Samples:
Measurements on contact with surface

Location ID	cpm (ESP-2 w/44 - 9 G-M)	cpm (model 2221/ 44 - 10)	μR/hr (Ludlum M-19)
1	102	4051	14.5
2	89.7	4450	15.5

Table 3: Sample Laboratory Results:

Sample Location / ID	Gross Alpha pCi/g	Gross Beta pCi/g	Gamma Spec	
			Isotope	pCi/g
6 / 1	25.6 ± 2.3	33.4 ± 2.4	K-40	24.0 ± 0.4
			Cs-137	0.039 ± 0.0009
			U-238	0.95 ± 0.59
			Ra-226	0.86 ± 0.03
			Th-232	1.20 ± 0.06
			Th-228	1.06 ± 0.05
			Ra-228	1.20 ± 0.06
			U-235	N.D.
7 / 2	23.7 ± 2.2	30.7 ± 2.3	K-40	24.9 ± 0.4
			Cs-137	0.149 ± 0.012
			U-238	0.86 ± 0.66
			Ra-226	0.87 ± 0.03
			Th-232	1.39 ± 0.07
			Th-228	1.28 ± 0.05
			Ra-228	1.39 ± 0.07
			U-235	0.12 ± 0.06

Summary:

The confirmation survey of the Building 4064 site shows the exposure rate as measured is at background levels and the analysis results of the soil samples are below the levels listed in the Sitewide Release Criteria for Remediation of Radiological Facilities. RHB staff reviewed the surveys completed by Rocketdyne and those of ORISE (Oak Ridge Institute for Science and Education) and found the surveys comprehensive and complete. These surveys indicate that the area is ready for release. Therefore the Building 4064 site may be released for unrestricted use.

RADIOCHEMICAL ANALYSIS REPORT
State of California-Department of Health Services
Sanitation & Radiation Laboratory
2151 Berkeley Way
Berkeley, CA 94704

Date & Time Sampled	Serial No.
7 October, 1998 14:10	R-74437
Date Received	**Lab No.**
13 October, 1998	98-2362

Collector's Name: Lisa Brown
Agency Address: DHS/RHB-Sacramento
Phone No.: 916-324-3731

Send Report To: Steve Hsu
Agency Address: Radiologic Health Branch
601 N. 7th St
Sacramento, CA
Phone No.: 916-322-4797

Sampling Point: ETEC
Location of Sample(s): Building 064
System No. (ODW): #1

[X] RHB ( ) [ ] ODW ( ) [ ] EMB ( ) [ ] RWQCB ( )
[ ] FDB ( ) [ ] DWR ( ) [ ] CDFG ( ) [ ] County HD
[ ] Other (specify):

Type of Sample

[ ] Air Filters: Meter Date/Time
Finishing: _____ ____/____
Starting: _____ ____/____
Net (M^3): _____
[ ] Air Charcoal Cartridge
[ ] Radon Canister

[ ] Drinking Water
[ ] Groundwater
[ ] Surface Water
[ ] Sea Water
[ ] Rain/Snow
[ ]Other (Specify)

[ ] Sewage/Sludge
[ ] Sewage/Effuent
[X]Soil/Sediment
[ ] Vegetation
[ ] Wipes

[ ] Milk
[ ] Fish/Shellfish
[ ] NPP Influent/Eff
[ ] Seaweed
[ ] Composites

The analyses were performed using the referenced methods. Precision criteria for these methods were determined to be acceptable.

R No./SRL No.	Sample Identification	Analysis	Results[1] + CE[2]	MDA_{95}[3]	Units	Dry wt./Wet wt.
74437/98-2362	Building 064 #1	K-40[4]	24.0 ± 0.4	0.1	pCi/g dry wt.	0.993
		Cs-137[4]	0.039 ± 0.009	0.011	pCi/g dry wt.	
		U-238 (Th-234, 63 keV)[4]	0.95 ± 0.59	0.63	pCi/g dry wt.	
		Ra-226 (Bi-214,609 keV)[4]	0.86 ± 0.03	0.02	pCi/g dry wt.	
		Th-232(Ac-228,911 keV)[4]	1.20 ± 0.06	0.04	pCi/g dry wt.	
		Th-228 (Tl-208,583 keV)[4]	1.06 ± 0.05	0.03	pCi/g dry wt.	
		Ra-228(Ac-228,911 keV)[4]	1.20 ± 0.06	0.04	pCi/g dry wt.	
		U-235 (144 keV)[4]	N.D.	0.08	pCi/g dry wt.	
		Gross Alpha[5]	25.6 ± 2.3	0.9	pCi/g dry wt.	
		Gross Beta[5]	33.4 ± 2.4	2.4	pCi/g dry wt.	

1. Results less than the Minimum Detectable Activity (MDA) are reported as not detected (N. D.).
2. CE is the counting error at the 95% confidence level as defined in Prescribed Procedures for Measurement of Radioactivity in Drinking Water, EPA-600/4-80-032, August 1980.
3. MDA_{95} is the sample specific minimum detectable activity at the 95% confidence level, which is the LLD_{95} divided by 2.22, the efficiency, and the yield, and may include factors for abundance, decay, and ingrowth, dependent on the particular radionuclide. LLD_{95} is defined in section 7010G, Standard Methods for the Examination of Water and Wastewater, American Water Works Association, 18th ed., 1992, where S_B is the square root of the instrument background count rate.
4. HASL-300, 27th Ed., Vol. 1, Rev. 2/92, Method 4.5.2.3, Environmental Measurements Laboratory, U.S. Department of Energy, New York, NY.
5. EPA Method 900.0, Prescribed Procedures for Measurement of Radioactivity in Drinking Water, EPA-600/4-8-032, August 1980, modified for soil.

Shilpamalie R. Ruben — Analyst/Radiochemist
12/17/98 — Date
Cindy L. Wong — Lead Person/Supervisor
12/30/98 — Date

2362.WP6

RADIOCHEMICAL ANALYSIS REPORT
State of California-Department of Health Services
Sanitation & Radiation Laboratory
2151 Berkeley Way
Berkeley, CA 94704

Date & Time Sampled	Serial No.
7 October, 1998 14:40	R-74438
Date Received	**Lab No.**
13 October, 1998	98-2361

Collector's Name: Lisa Brown
Agency Address: DHS/RHB-Sacramento
Phone No.: 916-324-3731

Send Report To: Steve Hsu
Agency Address: Radiologic Health Branch
601 N. 7th St
Sacramento, CA
Phone No.: 916-322-4797

Sampling Point: ETEC
Location of Sample(s): Building 064
System No. (ODW): #2

[X] RHB ( ) [ ] ODW ( ) [ ] EMB ( ) [ ] RWQCB ( )
[ ] FDB ( ) [ ] DWR ( ) [ ] CDFG ( ) [ ] County HD
[ ] Other (specify):

Type of Sample

[ ] Air Filters: Meter Date/Time
Finishing: _____ ____/____
Starting: _____ ____/____
Net (M^3): _____
[ ] Air Charcoal Cartridge
[ ] Radon Canister

[ ] Drinking Water
[ ] Groundwater
[ ] Surface Water
[ ] Sea Water
[ ] Rain/Snow
[ ]Other (Specify)

[ ] Sewage/Sludge
[ ] Sewage/Effuent
[X]Soil/Sediment
[ ] Vegetation
[ ] Wipes

[ ] Milk
[ ] Fish/Shellfish
[ ] NPP Influent/Eff
[ ] Seaweed
[ ] Composites

The analyses were performed using the referenced methods. Precision criteria for these methods were determined to be acceptable.

R No./SRL No.	Sample Identification	Analysis	Results[1] ± CE[2]	MDA_{95}[3]	Units	Dry wt./Wet wt.
74438/98-2361	Building 064 #2	K-40[4]	24.9 ± 0.4	0.1	pCi/g dry wt.	0.989
		Cs-137[4]	0.149 ± 0.012	0.011	pCi/g dry wt.	
		U-238 (Th-234, 63 keV)[4]	0.86 ± 0.66	0.74	pCi/g dry wt.	
		Ra-226 (Bi-214,609 keV)[4]	0.87 ± 0.03	0.02	pCi/g dry wt.	
		Th-232(Ac-228,911 keV)[4]	1.39 ± 0.07	0.04	pCi/g dry wt.	
		Th-228 (Tl-208,583 keV)[4]	1.28 ± 0.05	0.03	pCi/g dry wt.	
		Ra-228(Ac-228,911 keV)[4]	1.39 ± 0.07	0.04	pCi/g dry wt.	
		U-235 (144 keV)[4]	0.12 ± 0.06	0.08	pCi/g dry wt.	
		Gross Alpha[5]	23.7 ± 2.2	0.9	pCi/g dry wt.	
		Gross Beta[5]	30.7 ± 2.3	2.3	pCi/g dry wt.	

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5. EPA Method 900.0, Prescribed Procedures for Measurement of Radioactivity in Drinking Water, EPA-600/4-8-032, August 1980, modified for soil.

Shivamalli R. Ruberu — Analyst/Radiochemist — 12/28/98 — Date
Carolyn Z. Wong — Lead Person/Supervisor — 12/30/98 — Date

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